BRITISH COLUMBIA DEPARTMENT OF LANDS
FOREST SERVICE
HON. WILLIAM R. ROSS, K.C., Minister of Lands

British Columbia Timber for Prairie Farms

SILOS AND ROOT CELLARS

FARM BUILDINGS SERIES
BULLETIN No. 9

THE GOVERNMENT OF
THE PROVINCE OF BRITISH COLUMBIA.

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1915.

BRITISH COLUMBIA

LUMBER, SHINGLES

and other products of

Douglas Fir

Western Larch

Mountain Western Pine

Western Red Cedar

Western Hemlock

Spruce

Western White Pine

British Columbia Timber for Prairie Farms.

SILOS AND ROOT CELLARS.

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The
LUMBERING INDUSTRY OF BRITISH COLUMBIA.

TO THE PRAIRIE FARMER.

In the forests of British Columbia there stands to-day more than half Canada's supply of commercial timber. Forest surveys made during recent years throughout the Province show 30,000,000 acres of timber ready for the market, and 45,000,000 acres of younger growth that will reach commercial size during the present century. The present merchantable stand is estimated at 400,000,000,000 feet board measure.

Taught by the experience of older countries, British Columbia has adopted a vigorous conservation policy, and is carefully protecting her vast forest areas from fire and misuse.

The manufacture of lumber and other wood products is the most important industry of this forest Province. Each year 1,500,000,000 feet of timber is cut to supply the sawmills, pulp and paper mills, and other wood-using factories west of the Canadian Rockies. But the forests produce more wood each year than the mills can find markets for, and so much timber goes to waste. The most of the timber is public property; the prosperity of the Province depends very largely upon the lumbering industry; and it is therefore the duty of the Government to help secure the widest possible market for British Columbia lumber both in foreign countries and in Canada.

The main market for Western lumber to-day is in the Prairie Provinces of Canada. Each farm is, after all, a factory for agricultural produce and needs a well-built plant like any other factory. This means good buildings—a comfortable, convenient house, good barns, granaries, silos, fences and shelter for machinery. The best material for this is wood. It is cheap, handy to use, warm, sanitary, and it lasts. British Columbia therefore desires to give the citizens of Alberta, Saskatchewan, and Manitoba full information concerning her forest products, asking them to bear in mind that these products are "grown and manufactured in Canada," and that trade between the Provinces of the Canadian West is the surest foundation for our common prosperity.

The Bulletins.

Valuable bulletins on farm buildings are now being issued by agricultural authorities all over Canada and the United States. The College of Agriculture of the University of Saskatchewan was engaged in this most useful work; the Government of British Columbia entered into a co-operative agreement with the University, and the series of farm bulletins listed on the last page of this booklet is the result. The agricultural information contained herein and the plans and bills of material were prepared under the immediate supervision of Mr. W. J. Rutherford, Dean of the College of Agriculture, and thus give up-to-date and authoritative views on the agricultural subjects dealt with. The information concerning lumber is supplied by the Forest Service of the Government of British Columbia.

In the building plans, five things are aimed at in particular:—

(1.) That they should be specially designed to meet Prairie conditions.

(2.) That they should be simple and practical to meet the needs of the averge farmer.

(3.) That ordinary stock sizes of lumber should be used throughout in order to keep the cost low.

(4.) That it should be easy for the farmer to make additions to the buildings whenever more accommodation should be needed.

(5.) That the details of the plans should be readily alterable to suit individual needs.

The plans printed in these bulletins show enough detail for them to be used as working plans. Any one wishing to obtain large-scale working plans can secure them at cost by writing to the **Chief Forester, Victoria, B.C.** A reference list of bulletins and of sources of agricultural information will be found on the last page.

Note.

While it is understood that the agricultural authorities in Alberta and Manitoba have already published pamphlets on farm buildings, and contemplate issuing others, it is believed that all Prairie farmers will be interested in the British Columbia bulletins, and editions for general distribution on the Prairies have accordingly been printed.

UNIVERSITY OF SASKATCHEWAN,

COLLEGE OF AGRICULTURE.

WALTER C. MURRAY, *President*. W. J. RUTHERFORD, *Dean*.

Silos and Root Cellars for Prairie Farms.

By A. R. Greig, Professor of Agricultural Engineering, and A. M. Shaw, Professor of Animal Husbandry.

SILAGE.

SILAGE as a food for stock is not at present used to any very great extent in the Prairie Provinces of Canada, mainly because the corn-plant, which is pre-eminently the best silage-crop, is not as easily grown here as in regions farther south. There are, however, a number of silos that have been in operation for some time in each of the Provinces, and the results obtained have been uniformly good. More interest in this question is being shown each year, and the area given over to the growing of corn is increasing very rapidly. It is a crop that can be used to take the place of the bare fallow to a certain extent. If the corn is sown in rows and well cultivated, the land will be kept free from weeds, a certain amount of moisture conserved, and the grain-crop that succeeds it will be approximately as large as that produced on the bare fallow; in some cases even a greater yield of grain has been obtained after corn.

The summer frosts, although injuring the crops at times and retarding its growth, do not affect it as much as one might suppose. At the University of Saskatchewan during the season of 1915 the corn-crop was completely frozen off twice by June frosts some weeks apart. The plants were badly blackened and apparently destroyed, but recovered quickly, and on September 1st the corn averaged between 5 and 6 feet in height. In more favourable seasons a much better growth could be obtained.

Although corn is considered the best crop for silage purposes because of the great tonnage that can be grown per acre, there are some other crops at present being tested that give good promise,

especially for northern districts. The first of these is wheat. Wheat has been used to some extent as silage, and has so far given quite satisfactory results. It must be cut when in the dough stage, which means that the silo has to be filled much earlier in the season than when corn is used. Peas and oats are also crops that will yield a tremendous tonnage per acre when cut in the green state, but as yet their suitability for silage has not been thoroughly tested. Some attention has also been given to sweet clover, and the time may come when this much-maligned plant will prove to be immensely valuable as a silage-crop in Western Canada.

The use of silage is to be recommended to the farmer and dairyman of the Prairies, for in no other way can he provide so much excellent feed for winter use. It furnishes the necessary succulence and tends to make the winter ration more nearly resemble the summer feeds, and thus adds greatly to the milk-flow and also to the general thrift of the animals. Not only is silage an especially good winter feed, but it is also useful to bridge over dry spells, or to feed when the grass is drying up in the late summer. Where two silos are used, one for winter feeding and one for summer, the farmer is in a position to furnish his cows with the best of food at all times.

Though silage is best known on account of its value in milk production, it is also a splendid food for beef cattle, and may be fed to advantage, in smaller quantities and with more care, to horses and sheep. It is not so generally used for hogs, except occasionally as an appetizer.

LOCATION OF SILO.

The best place, as a rule, for the silo is adjacent to the barn, close to the feed-room and connected with it by the silo-chute. It is then most convenient for feeding and the connection gives it additional wind-firmness. It is preferable also to have it on the north side of the barn, where it breaks the north winds, does not obstruct the sunlight, and dries out less in summer. In the case of a bank barn the silo is most convenient and economical if built into the bank.

SIZE OF SILO.

The size will depend mainly on the number and kind of live stock kept and the number of days in the year they are to be fed.

Diameter.—The first thing to determine is the diameter. After starting to use the silage a certain amount must be fed off the top each

day or the surface will mould. This amount will vary with the kind of silage, its ripeness when cut, the firmness of its packing in the silo, and whether it is fed in summer or winter. Ordinarily it will be necessary to feed off a layer of about 2 inches daily in winter, and twice that in summer. Expressed in terms of pounds, the minimum quantities which should be fed daily to prevent spoiling are approximately as follows:—

Silo Diameter in Feet.	Minimum Pounds in Winter.	Minimum Pounds in Summer.	Silo Diameter in Feet.	Minimum Pounds in Winter.	Minimum Pounds in Summer.
8	150	300	14	480	960
10	250	500	16	600	1,200
12	350	700	18	760	1,520

There is some difference of opinion as to the silage rations which should be provided for different kinds of stock during winter, or during any time when no other green feed is available, but the following are average figures:—

Dairy cows	....	30 to 40 lb.	per day.
Beef cattle	....	25 to 30 ,,	,,
Calves (500 lb.)	....	10 to 12 ,,	,,
Horses	....	10 to 12 ,,	,,
Colts (500 lb.)	....	4 to 5 ,,	,,
Sheep	....	2 to 3 ,,	,,

From the above two tables it is easy to determine the diameter a silo should be for a given number of stock. For example, for a herd of twelve dairy cows, fed during winter 40 lb. each or altogether 480 lb. per day, the silo should not be greater than 14 feet in diameter; if silage is to be used for summer feed, then the silo should not be greater than 9 feet in diameter.

Height.—With the diameter fixed, the height will be governed by the amount of silage to be stored, and this in turn depends on the number and kind of stock kept and the length of the silage-feeding season. For example, twelve dairy cows fed 480 lb. per day for six months, or 180 days, would require 86,400 lb., or over 43 tons. Referring to the bill of material for Stave Silo No. 1 or No. 2, given farther on in this bulletin, it is seen that there are several sizes which will answer; for example, 10 x 30 feet with a capacity of 44 tons, 11 x 26 feet with the same capacity, and 12 x 24 feet with a capacity of 47 tons.

High, narrow silos are preferable to low, wide ones, because the silage packs and keeps better in the former. It is better to build two small or medium-sized silos than one of very large size, because the smaller ones are stronger and more convenient to fill and to empty.

REQUIREMENTS OF A SILO.

After a crop is put into a silo it must undergo certain physical and chemical changes due to fermentation before it is converted into silage. The fermentation, which is accompanied by a rise in temperature or heating of the silage, is caused by various bacteria and yeasts which are always present. By their action the sugar of the plant is converted into acids (among which lactic acid and acetic acid or vinegar are prominent) which preserve the silage as long as air is excluded, and also the fibre of the plant is softened and made much more appetizing and digestible. Most of this process takes place in from four to ten days after the silo is filled, though a very slow acid accumu'ation occurs for several weeks following this period.

The two conditions essential for fermentation are warmth (a temperature of 70° Fahr. and above is necessary) and exclusion of air. The necessary warmth, as stated above, is generated naturally during the fermentation process. The heat must be kept in and the air must be kept out by the walls of the silo, and the close packing of the silage, otherwise the acid-forming bacteria will not grow, but instead organisms are likely to develop which will cause rotting and moulding of the silage.

The above conditions govern the qualities which a silo must possess in order to give the best results, and which may be summed up as follows:—

(1.) The walls should be air-tight and moisture-tight to allow fermentation and to prevent moulding and rotting.

(2.) The material of which the walls are built should be a non-conductor of heat and cold, in order to retain the warmth generated in the silage during the fermentation process, which warmth is so essential for the growth and work of the acid-forming bacteria, and also in order to keep out the cold and prevent excessive freezing, especially when the silage is to be used during the winter.

(3.) The height of the silo should be preferably at least twice its diameter, so that the silage will, by its own weight, pack down closely and tightly, expel the air, and cure thoroughly all through. The

deeper the silo the greater the pressure at the bottom, and the more compactly and tightly the silage is pressed together. For this reason a high, narrow silo will hold more silage and keep it better than a low, wide one; also the layer of silage necessary for daily feeding is thinner at the middle or bottom of a silo than at the top.

(4.) The inner surface of the walls should be smooth, perpendicular, and free from corners, in order to allow the silage to settle freely and evenly without leaving air pockets or cavities. Round silos are much superior to those with angles or corners inside.

(5.) The silo must be strong to resist the great pressure of the mass of silage; this pressure increases toward the bottom, and therefore the silo needs to be stronger at the bottom than the top. It is also desirable, of course, that it be durable, cheap, and easy to build and keep in repair.

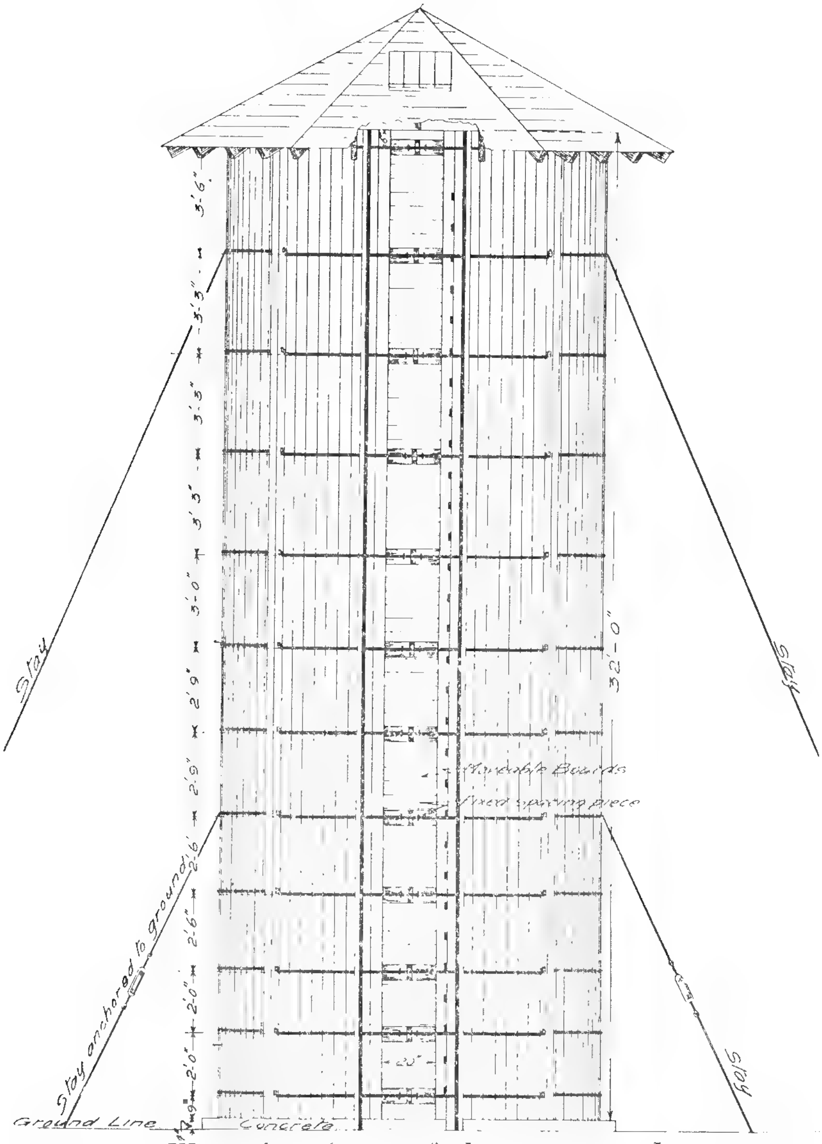
A good many different materials, such as wood, stone, clay blocks, concrete, and iron, though they differ widely in cost and ease of erecting, can be used and have been used for making silos, as anybody who investigates the subject will learn. However, the great majority of silos now in use are of the round or tub type, built of wooden staves, and most authorities are agreed that it is the most satisfactory kind —everything considered - for the average farmer. If properly constructed, the stave silo incorporates practically all the essential qualities mentioned above; it is the right shape, the walls are tight, perpendicular, and very smooth, and wood is practically a non-conductor of heat and cold. The stave silo is also the cheapest and much the easiest to build and maintain, or to move to a new site and rebuild, should that ever prove necessary.

BUILDING THE SILO.

Stave Silo No. 1.

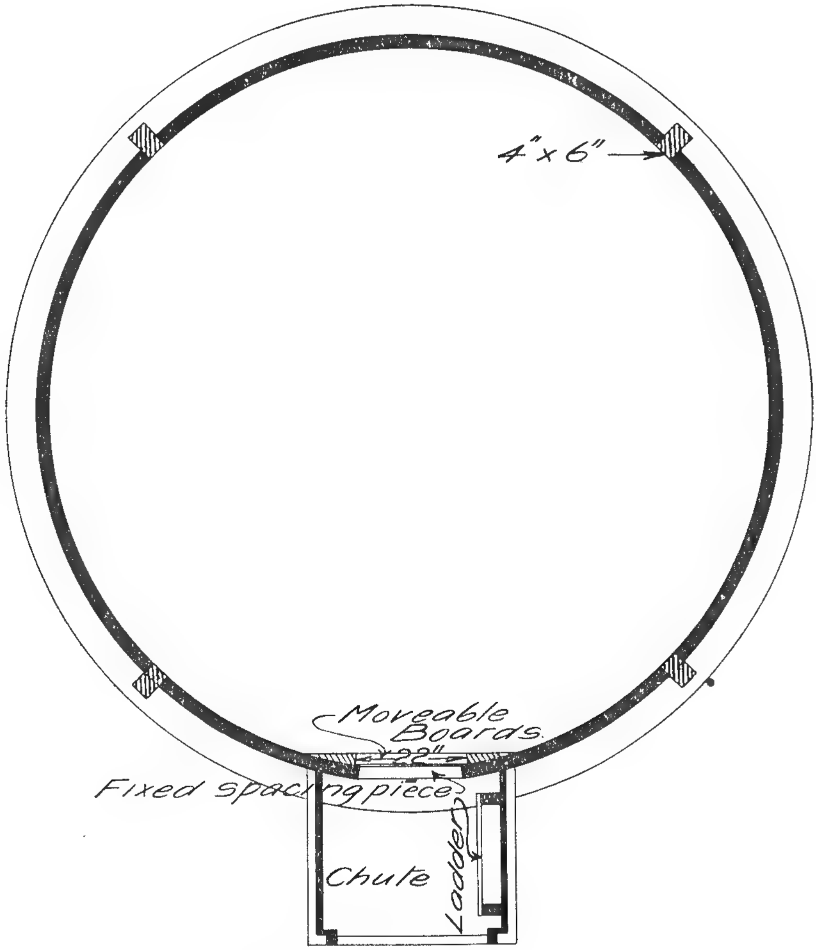
Foundation.—The foundation-wall should be broad (at least 12 inches wide) and well bedded in *solid* ground, deep enough to avoid frost-heaving. If a pit or cellar is used, care should be taken to have the inside face of the staves approximately even with the inside wall of the pit, so that there will be no wide ledge to hinder the silage from settling properly. Three different types of concrete foundation, each of them suitable for a stave silo, are described below: -

Stave Silo No. 1.



Elevation, front of chute removed.

Fig. 1. Except for the fixed spacing-pieces, which hold the floor-frame rigid, the door is continuous, and can be taken out in 6 inch sections. The foundation is simply a round, flat slab of concrete.



Plan of Stave Silo No. 1.

Fig. 2. The two bevel strips inside, one on each side of the doorway, hold the movable door-boards in place. Pockets can be made in the chute to store the door-boards as they are taken out; or else, as the silo is emptied, the door-boards above the opening can be blocked in place.

No. 1 is a circular or ring-shaped wall about 12 inches thick, with the staves resting on the centre of the wall (*see* Fig. 3). The method of construction is as follows:—

Make a circle-marker as shown in Fig. 4. Fix the two marking-pieces 12 inches (the thickness of the wall) apart, the inner one being

at a distance from the centre 5 inches less than half the inside diameter of the silo, and mark the two circles on the ground (*see* Fig. 5). This leaves 5 inches of wall both inside and outside the 2-inch staves, which stand on the middle of the wall. Theoretically the inside faces of the

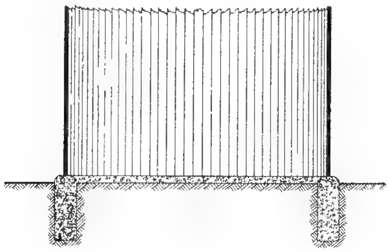


Fig. 3. A common form of silo foundation simply a ring-shaped wall.

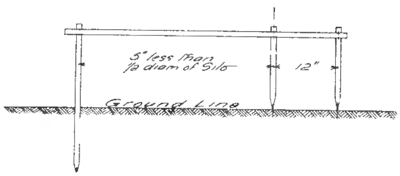


Fig. 4. A simple device for marking out the foundation.

foundation-wall and the staves should be exactly flush, but it is necessary to have a wide surface for the staves to rest on, because it is difficult to get the inside of the silo perfectly round, and also because the staves will shrink a certain amount when dry.

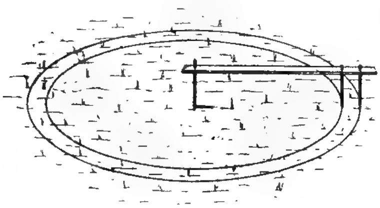


Fig. 5. Marking the lines for the foundation.

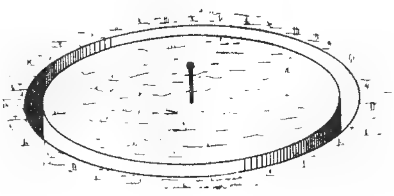


Fig. 6. The trench dug ready for the foundation.

Next excavate a trench between the two circles, going down to a solid bottom (*see* Fig. 6). The inside of the trench should be smooth and firm, as it will be part of the form for the concrete wall. The top of the foundation-wall should be at least 6 inches above the ground grade, and must be absolutely level. Make wooden forms for this; using water-soaked ½-inch boards, bent round to the circle and fixed to 2- x 4-inch stakes firmly driven into the ground; be sure that the top edges of the boards are exactly level.

The trench and forms are now ready to receive the concrete. Mix the concrete on a clean board platform, in the proportion of five

parts of gravel to one of cement. The mixture should be thoroughly turned over twice dry and twice wet. Sufficient water should be added to make the mixture of a thick creamy consistency. A convenient quantity of concrete to mix at one time is made up of one bag of cement with five times that quantity of clean gravel. Next proceed to fill the trench and forms. Do not attempt to fill one part of the trench full to the top, but place each mixing in a layer all round the foundation.

Base anchor-bolts are not altogether essential, but will give the silo additional firmness if used. Four would be required, each about ½ x 24 inches, with an eye in the upper end and a hook or elbow in the lower end. Space them around the foundation-wall just outside where the staves will come, with about two-thirds their length sunk in the concrete. After the silo is completed, bolt them to the adjoining staves.

Having filled the trench and forms to the top of the ½-inch boards, take a straight-edged strip of wood and puddle and scrape the top of the concrete exactly level with the top of the forms. The concrete should be left two or three days to set, and the forms can then be removed. Before the concrete has hardened (about five or six hours after filling), scratch a circle on the top of the wall, 5 inches from the inner edge of the foundation, with a large nail driven into the circle-marker. This circle will mark the position of the inside face of the staves, and will serve as a guide when erecting them.

By digging out the earth inside the foundation-wall a little greater storage capacity may be secured. An objection to this, however, is the ledge formed inside the staves by the top of the wall, which interferes to some extent with the settling of the silage at that point. For this reason some prefer to fill the inside level to the top of the wall with earth, or to put in a layer of straw before filling the silo, or to put in a concrete floor. If the earth is dry and firm a concrete floor is not necessary, though it makes the silo easier to clean, and prevents rodents from burrowing underneath the silo. If the earth is rather wet a concrete floor should be made, draining to a hole in the middle, with a tile drain underneath. The hole should be plugged before the silo is filled, and kept open when it is empty.

Foundation No. 2 consists of a 12-inch ring wall like No. 1, with the space inside the wall excavated and filled in with a concrete bottom shaped in the form of a deep dish (*see* Fig. 13). This dish should

have a 3- or 4-inch hole in the middle, connected to a tile drain and stopped with a wooden plug.

Foundation No. 3 is simply a flat circular concrete slab, projecting 5 or 6 inches beyond the outside face of staves (*see* Fig. 1).

Foundations Nos. 2 and 3 are set out and built in much the same way as No. 1, the difference being clearly shown by the drawings.

Scaffolding.—This can be put up in so many different ways, both inside and outside the silo, that no special form will be described here in detail. One of the simplest and most convenient methods is to build the scaffolding inside, in the form of a stool or bench about half the height of the silo. The top of the silo can then be reached by means of a short ladder placed on the stool.

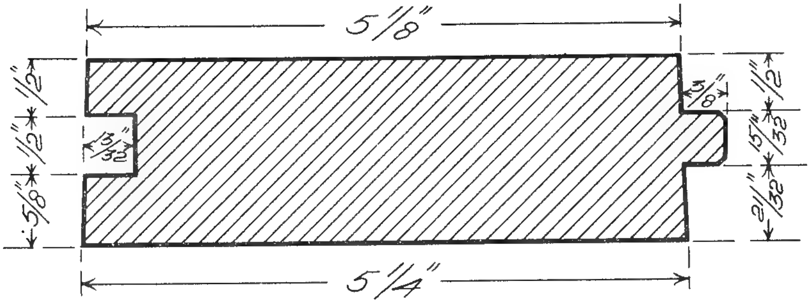
Posts and Hoops.—For silos up to 11 feet in diameter three 4- x 4-inch posts are used; when over 11 feet, four posts are used. These posts each take the place of a stave and act as a framework to the silo. The first operation is to bore holes in the posts at intervals corresponding to the spacing of the iron hoops. In continuous-door silos like No. 1 the spacing of the hoops increases with the height of the silo; the first hoop should be 6 inches from the bottom, the next 2 feet higher up, and the distance apart is then increased a little each time up to the top, where it may be 3½ feet. Bore the holes through the posts at an angle, entering the post against one of the adjoining staves and coming out 1 inch from the other adjoining stave.

The hoops specified in the bills of material are all made of ¾-inch round-iron rods, threaded 6 inches at both ends, and supplied with nuts and malleable washers. An alternative and somewhat cheaper method is to put heavy hoops on the lower part of the silo and lighter ones above. Thus, for silos up to 14 x 30 feet, use ⅝-inch hoops on the lower two-thirds of the silo and ½ inch on the upper third; for silos larger than 14 x 30 feet, use ¾-inch, ⅝-inch, and ½-inch hoops respectively on each third, from the bottom up. If lighter hoops than those specified in the bills of material are used, however, more of them should be put on.

If possible, buy the rods already bent to the circumference of the silo; if only straight ones are available, they can be heated and bent on a form in the same manner that a blacksmith bends tires for a wagon-wheel. After the holes are bored, set the posts up firmly, brace and carefully plumb them, and insert the hoops.

(If preferred, iron lugs may be used instead of nuts and washers, and the posts would then be unnecessary. These lugs are sometimes difficult to get, however, and they really answer the purpose no better.)

Silo stave for 12-foot Silo.



Section.

Fig. 7. The dimensions in cross-section of a tongued and grooved stave for a silo 12 feet in diameter.

Staves.—A section of one of the 2- x 6-inch tongued and grooved staves is shown in Fig. 7. Either full-length or spliced staves may be used; full-length staves are more convenient to use, while spliced staves are cheaper. The method of splicing staves is shown in Fig. 8. A saw-cut is made in each of the adjoining ends of the two staves, and a strong spline or plate of galvanized or coppered iron the full width of the stave is inserted.

The posts and staves should be made of strong durable wood, resistant to water-soakage; Douglas Fir and Western Larch are both suitable. It is a good plan to put tar or creosote on the lower ends of the staves which will rest on the foundation. Do not paint or creosote the staves on the inside, as it may taint the silage; leave them clean just as they come from the mill.

Having placed the posts and hoops in position, next proceed to put up the staves. This will require one man on the scaffold and another on the ground, the staves being pulled up between the iron hoops about half-way up the silo and then lowered into place. First erect the two staves on either side of the door opening with the horizontal spacing-pieces between them, and the 2- x 6-inch bevel-cut door-board guides on the inside; these staves form the door-frame

and must be set and braced exactly plumb. The rest of the staves can then be erected, working each way from the door. They may be put up either one by one, or several may be fastened together by barrel staves and put up at once.

As the staves are erected, hold them in place by driving staples over the hoops; if the wood is very hard it may be necessary to bore holes for them. Before the silo is completed, each hoop should be stapled to every second stave in order to prevent the staves from getting out of place in the summer, when if the silo is empty the staves will dry and shrink a certain amount. Do not drive the staples all the way in, but leave plenty of room for the rods to slide easily through them. After the staves are up, gradually tighten each hoop, one after the other, until they all have an equal amount of strain.

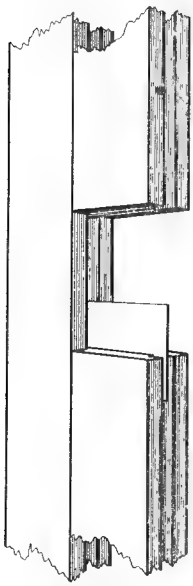


Fig. 8. Splicing staves. A saw-cut is made in the end of each piece, in which is inserted a rust-proof metal plate or spline the full width of the stave.

If two piece staves are used, the entire bottom part of the silo can be put up and hooped loosely before the upper pieces are put in place. The joints should always be broken (i.e., placed alternately at different heights on the silo).

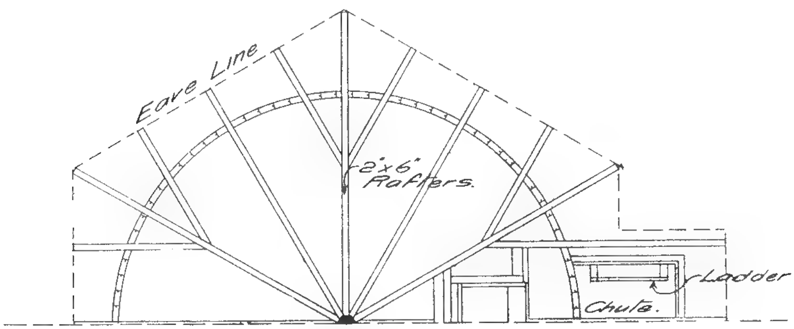
Anchor-stays.—The six stays or guy-wires should each have a turnbuckle 4 or 5 feet from the ground, to allow them to be tightened and slackened. Attach them to the silo and securely anchor them either to concrete blocks or heavy timbers sunk in the ground. Then adjust them so that the silo is *exactly plumb* and the tension is the same on each; this is very important and should be carefully done.

Roof.—A roof is not absolutely essential, but it strengthens the silo, protects the silage from rain and snow, and if it is tight, helps a good deal in keeping out frost. A shingle roof is shown for this silo, and recommended as being the warmest and most durable.

Cut and fit the roof timbers and boarding on the ground, and mark each rafter and board (*see* Fig. 9). They can then be hoisted and fixed in position at once, or left until the silo is filled. Before putting the roof on, measure across the top of the silo in several places to see that it is round. If it is not round, it must be adjusted until it is; to do this it may be necessary to insert another stave, or to take one out.

The trap-door for filling the silo can be placed in any one of the six sides of the roof. It should be made in the form of a lid with overlapping sides; once the silo is filled, it can be screwed on and left until the next time for filling.

Doors.—It is an advantage to have the doors for removing the silage arranged so that the minimum amount of silage will have to be disturbed when a door is taken out. For this reason continuous doors are more convenient than the non-continuous types. The continuous door shown in this silo consists simply of short lengths of stave laid



Half plan of roof of Stave Silo No. 1.

Fig. 9. A six-sided shingle roof—easier to make than a round roof. The pieces should first be cut, fitted, and marked on the ground.

horizontally between the 2- x 6-inch bevel guides, and fixed spacing-pieces placed where the hoops cross the doorway (*see* Figs. 1 and 2). It is thus necessary to remove only one 6-inch section at a time. These lengths should be cut so as to slide up and down freely. Pockets to hold six or eight of the door-boards should be placed at convenient intervals on the inside of the chute. A pocket can be made of a piece of 2 x 4 nailed across an inside face of the chute for the lower ends of the boards to rest on, with another piece nailed a short distance above it and blocked out from the face of the chute to hold the upper ends of the boards.

The construction of an alternative continuous door suitable for any stave silo is shown in Fig. 10. The ½- x 2-inch iron spacing-rods, which also serve as ladder-rungs, should be spaced from 16 to 20 inches apart.

Alternative door for Stave Silos.

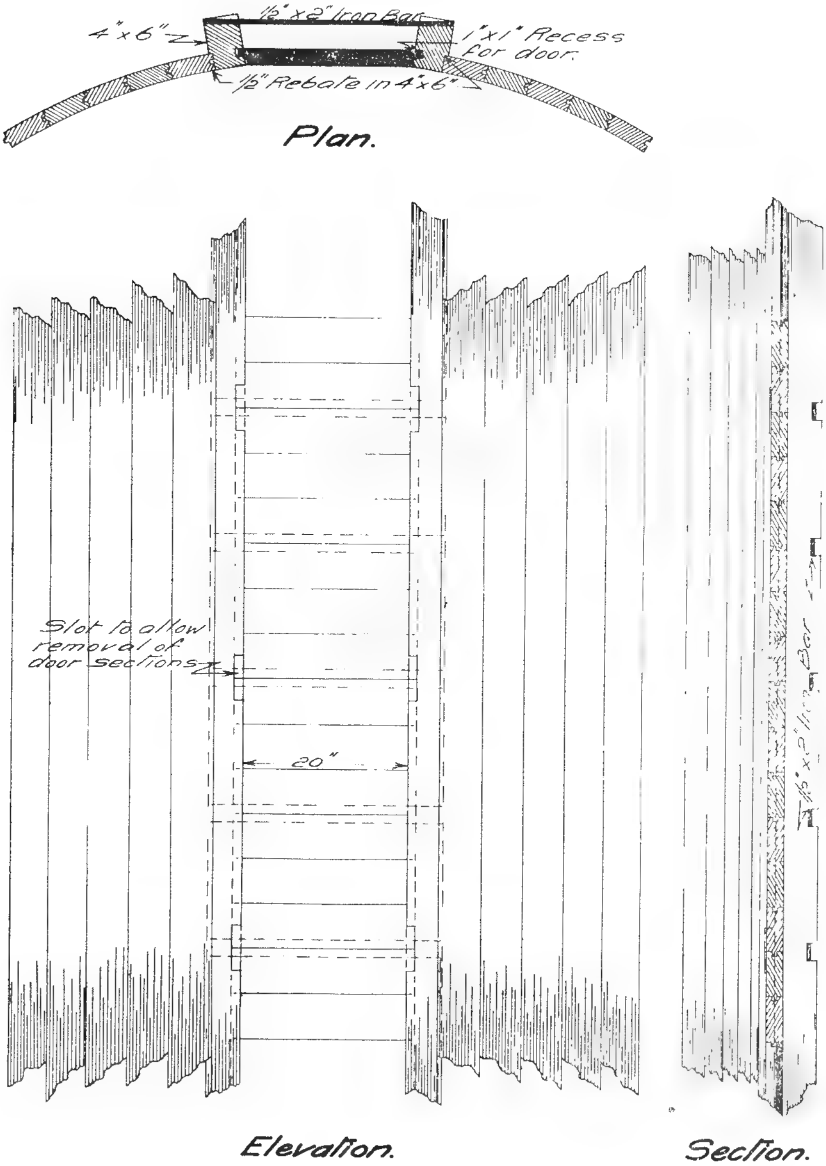


Fig. 10. Another form of continuous door suitable for any stave silo. The door-boards are simply pieces of 2- x 6-inch stave. The iron bars act as spacers to hold the door-frame rigid, and also serve as ladder-rungs.

Bill of Material, Stave Silo No. 1.

Outside Size. Diameter.	Outside Size. Height.	Approximate Capacity.	No. of Pieces of 2" x 6" Staves.	No. of Pieces of 4" x 6" Posts.	Lin. Feet 2" x 6" Splayed Door-guides.	No. of Pieces of 2" x 6" x 2' Stave for Doorway.	No. of Pieces of 2" x 6" x 12' for Rafters.	No. of Pieces of 2" x 6" x 10' for Rafters.	Ft., Board Measure, 1" Roof boarding.	Lin. Feet 2" x 4" Framing for Chute.	Ft., Board Measure, 1" D.&M. Boarding to Sides of Chute.	Lin. Feet 2" x 3" for Ladder-rungs.	Shingles for Roof.	4" Common Nails.	2½" Common Nails.	1¼" Galvanized or Zinc-clad Shingle-nails.	No. of Iron Rods ¾" Diameter for Hoops.	Length of Iron Rods.	2½" Staples.	Nuts and Washers for ¾" Iron Rods.
Ft.	Ft.	Tons.											Bdls.	Lb.	Lb.	Lb.		Ft. in.	Gross.	
8	20	15	54	3	40	46	....	12	200	180	300	40	8	10	10	10	21	9 0½	2	42
9	20	20	61	3	40	46	....	12	200	180	300	40	8	10	10	10	21	10 1	2	42
9	24	25	61	3	48	56	....	12	200	200	360	48	8	10	11	10	24	10 1	2	48
9	26	28	61	3	52	60	....	12	200	210	390	52	8	10	12	10	27	10 1	2	54
10	20	25	68	3	40	46	12	....	220	180	300	40	9	10	10	11	24	11 2	2	48
10	24	32	68	3	48	56	12	....	220	200	360	48	9	10	12	11	27	11 2	2	54
10	26	35	68	3	52	60	12	....	220	210	390	52	9	10	12	11	27	11 2	2½	54
10	28	40	68	3	56	64	12	....	220	220	420	56	9	10	13	11	30	11 2	2½	60
10	30	44	68	3	60	69	12	....	220	230	450	60	9	10	14	11	33	11 2	2½	66
11	20	32	76	3	40	46	12	....	260	180	300	40	10	11	11	13	24	12 2½	2	48
11	22	36	76	3	44	51	12	....	260	190	330	44	10	11	12	13	24	12 2½	2	48
11	24	40	76	3	48	56	12	....	260	200	360	48	10	11	13	13	27	12 2½	2½	54
11	26	44	76	3	52	60	12	....	260	210	390	52	10	11	13	13	27	12 2½	2½	54
11	28	49	76	3	56	64	12	....	260	220	420	56	10	11	14	13	30	12 2½	3	60
11	30	54	76	3	60	69	12	....	260	230	450	60	10	11	14	13	33	12 2½	3	66
12	22	41	83	4	44	51	....	18	300	190	330	44	12	12	13	15	36	10 1	2½	72
12	24	47	83	4	48	56	....	18	300	200	360	48	12	12	14	15	36	10 1	2½	72
12	26	52	83	4	52	60	....	18	300	210	390	52	12	12	14	15	40	10 1	3	80
12	28	58	83	4	56	64	....	18	300	220	420	56	12	12	15	15	40	10 1	3	80
12	30	64	83	4	60	69	....	18	300	230	450	60	12	12	15	15	44	10 1	3½	88
12	32	70	83	4	64	72	....	18	300	240	480	64	12	12	16	15	48	10 1	3½	96
13	24	55	90	4	48	56	12	6	340	200	360	48	14	13	14	17	36	10 10½	3	72
13	26	62	90	4	52	60	12	6	340	210	390	52	14	13	15	17	40	10 10½	3	80
13	28	69	90	4	56	64	12	6	340	220	420	56	14	13	15	17	40	10 10½	3½	80
13	30	76	90	4	60	69	12	6	340	230	450	60	14	13	16	17	44	10 10½	3½	88
13	32	83	90	4	64	72	12	6	340	240	480	64	14	13	16	17	48	10 10½	3½	96
14	26	72	97	4	52	60	12	6	380	210	390	52	15	14	16	19	40	11 8	3½	80
14	28	80	97	4	56	64	12	6	380	220	420	56	15	14	16	19	40	11 8	3½	80
14	30	88	97	4	60	69	12	6	380	230	450	60	15	14	17	19	44	11 8	3½	88
14	32	96	97	4	64	72	12	6	380	240	480	64	15	14	17	19	48	11 8	4	96
15	26	83	104	4	52	60	12	6	420	210	390	52	17	15	16	21	40	12 5½	4	80
15	28	92	104	4	56	64	12	6	420	220	420	56	17	15	17	21	40	12 5½	4	80
15	30	102	104	4	60	69	12	6	420	230	450	60	17	15	18	21	44	12 5½	4	88
15	32	110	104	4	64	72	12	6	420	240	480	64	17	15	18	21	48	12 5½	4½	96
16	26	94	111	4	52	60	12	6	440	210	390	52	18	16	17	22	40	13 3	4	80
16	28	104	111	4	56	64	12	6	440	220	420	56	18	16	17	22	44	13 3	4	88
16	30	115	111	4	60	69	12	6	440	230	450	60	18	16	18	22	44	13 3	4½	88
16	32	126	111	4	64	72	12	6	440	240	480	64	18	16	18	22	48	13 3	4½	96
16	34	138	111	4	68	77	12	6	440	250	510	68	18	16	19	22	48	13 3	4½	96

Staves.—The numbers given are for full-length pieces; if spliced staves are used, the numbers must be increased accordingly.

Roof Centre Post.—In all cases add one piece, 6" x 6" x 1', to which the tops of the rafters will be fixed.

Chute-door.—Add material for a door at the bottom of the chute, if one is required.

Foundation.—For a diameter of 12 feet about 10 yards of gravel and 53 bags of cement are required; for other diameters add or subtract about 15 per cent. for each foot difference in diameter.

Anchor-cables.—Use 7-strand No. 9 wire cable, or else about 8 strands of No. 9 wire twisted together. A silo 32 feet high will require approximately 200 feet (three guys 44 feet and three 22 feet) and 6 turnbuckles; for other heights add or subtract about 10 feet for each 2 feet difference in height. If the silo is connected to the barn fewer guys will be needed.

Base Anchor-bolts.—Four in each case, size about ½" x 24", eye in upper end, hook or elbow in lower end. The use of these is optional with the builder.

Bill of Material, Stave Silo No. 2.

Outside Size. Diameter.	Outside Size. Height.	Approximate Capacity.	No. of Pieces of 2" x 6" Staves.	No. of Pieces of 4" x 6" Posts.	No. of Pieces of 1" x 4" x 2' 10" for Door-stops.	No. of Pieces of 2" x 2" x 1' 5" for Door-battens.	No. of Pieces of 2" x 6" x 12' for Rafters.	No. of Pieces of 2" x 6" x 10' for Rafters.	Ft., Board Measure, 1" Roof-boarding.	Lin. Ft. 2" x 4" Framing for Chute.	Ft., Board Measure, 1" D. & M. Boarding for Sides of Chute.	Lin. Feet 2" x 3" for Ladder-rungs.	Shingles for Roof.	4" Common Nails.	2½" Common Nails.	1¼" Galvanized or Zinc-clad Shingle-nails.	No. of Iron Rods ¾" Diameter for Hoops.	Length of Iron Rods.		2½" Staples.	6" T-hinges on Doors.	4" Iron Buttons on Doors.	Nuts and Malleable Washers for ¾" Iron Rods.
Ft.	Ft.	Tons.											Bdls.	Lb.	Lb.	Lb.		Ft.	in.	Gross.			
8	20	15	58	3	10	10	....	12	200	180	300	40	8	10	10	10	33	9	0½	2	5	5	66
9	20	20	65	3	10	10	....	12	200	180	300	40	8	10	10	10	33	10	1	2	5	5	66
9	24	25	65	3	12	12	....	12	200	200	360	48	8	10	11	10	36	10	1	2	6	6	72
9	26	28	65	3	12	12	....	12	200	210	390	52	8	10	12	10	39	10	1	2	6	6	78
10	20	25	72	3	10	10	12	....	220	180	300	40	9	10	10	11	33	11	2	2	5	5	66
10	24	32	72	3	12	12	12	....	220	200	360	48	9	10	12	11	36	11	2	2	6	6	72
10	26	35	72	3	12	12	12	....	220	210	390	52	9	10	12	11	39	11	2	2½	6	6	78
10	28	40	72	3	14	14	12	....	220	220	420	56	9	10	13	11	42	11	2	2½	7	7	84
10	30	44	72	3	14	14	12	....	220	230	450	60	9	10	14	11	45	11	2	2½	7	7	90
11	20	32	80	3	10	10	12	....	260	180	300	40	10	11	11	13	33	12	2½	2	5	5	66
11	22	36	80	3	10	10	12	....	260	190	330	44	10	11	12	13	33	12	2½	2	5	5	66
11	24	40	80	3	12	12	12	....	260	200	360	48	10	11	13	13	36	12	2½	2½	6	6	72
11	26	44	80	3	12	12	12	....	260	210	390	52	10	11	13	13	39	12	2½	2½	6	6	78
11	28	49	80	3	14	14	12	....	260	220	420	56	10	11	14	13	42	12	2½	3	7	7	84
11	30	54	80	3	14	14	12	....	260	230	450	60	10	11	14	13	45	12	2½	3	7	7	90
12	22	41	87	4	10	10	....	18	300	190	330	44	12	12	13	15	44	10	1	2½	5	5	88
12	24	47	87	4	12	12	....	18	300	200	360	48	12	12	14	15	48	10	1	2½	6	6	96
12	26	52	87	4	12	12	....	18	300	210	390	52	12	12	14	15	52	10	1	3	6	6	104
12	28	58	87	4	14	14	....	18	300	220	420	56	12	12	15	15	56	10	1	3	7	7	112
12	30	64	87	4	14	14	....	18	300	230	450	60	12	12	15	15	60	10	1	3½	7	7	120
12	32	70	87	4	16	16	....	18	300	240	480	64	12	12	16	15	64	10	1	3½	8	8	128
13	24	55	94	4	12	12	12	6	340	200	360	48	14	13	14	17	48	10	10½	3	6	6	96
13	26	62	94	4	12	12	12	6	340	210	390	52	14	13	15	17	52	10	10½	3	6	6	104
13	28	69	94	4	14	14	12	6	340	220	420	56	14	13	15	17	56	10	10½	3½	7	7	112
13	30	76	94	4	14	14	12	6	340	230	450	60	14	13	16	17	60	10	10½	3½	7	7	120
13	32	83	94	4	16	16	12	6	340	240	480	64	14	13	16	17	64	10	10½	3½	8	8	128
14	26	72	101	4	12	12	12	6	380	210	390	52	15	14	16	19	52	11	8	3½	6	6	104
14	28	80	101	4	14	14	12	6	380	220	420	56	15	14	16	19	56	11	8	3½	7	7	112
14	30	88	101	4	14	14	12	6	380	230	450	60	15	14	17	19	60	11	8	3½	7	7	120
14	32	96	101	4	16	16	12	6	380	240	480	64	15	14	17	19	64	11	8	4	8	8	128
15	26	83	108	4	12	12	12	6	420	210	390	52	17	15	16	21	52	12	5½	4	6	6	104
15	28	92	108	4	14	14	12	6	420	220	420	56	17	15	17	21	56	12	5½	4	7	7	112
15	30	102	108	4	14	14	12	6	420	230	450	60	17	15	18	21	60	12	5½	4	7	7	120
15	32	110	108	4	16	16	12	6	420	240	480	64	17	15	18	21	64	12	5½	4½	8	8	128
16	26	94	115	4	12	12	12	6	440	210	390	52	18	16	17	22	52	13	3	4	6	6	104
16	28	104	115	4	14	14	12	6	440	220	420	56	18	16	17	22	56	13	3	4	7	7	112
16	30	115	115	4	14	14	12	6	440	230	450	60	18	16	18	22	60	13	3	4½	7	7	120
16	32	126	115	4	16	16	12	6	440	240	480	64	18	16	18	22	64	13	3	4½	8	8	128
16	34	138	115	4	16	16	12	6	440	250	510	68	18	16	19	22	64	13	3	4½	8	8	128

Staves.—The numbers given are for full-length pieces; if spliced staves are used, the numbers must be increased accordingly.

Roof Centre Post.—In all cases add one piece, 6" x 6" x 1', to which the tops of the rafters will be fixed.

Chute-door.—Add material for a door at the bottom of the chute, if one is required.

Foundation.—For a diameter of 12 feet about 10 yards of gravel and 53 bags of cement are required; for other diameters add or subtract about 15 per cent. for each foot difference in diameter.

Anchor-cables.—Use 7-strand No. 9 wire cable, or else about 8 strands of No. 9 wire twisted together. A silo 32 feet high will require approximately 200 feet (three guys 44 feet and three 22 feet) and 6 turnbuckles; for other heights add or subtract about 10 feet for each 2 feet difference in height. If the silo is connected to the barn fewer guys will be needed.

Base Anchor-bolts.—Four in each case, size about ½" x 24", eye in upper end, hook or elbow in lower end. The use of these is optional with the builder.

Chute.—The chute is built of 2- x 4-inch studding and rails and covered on the inside with 1-inch vertical dressed and matched boarding. The ladder on the inside of the chute has 2- x 4-inch sides and 2- x 3-inch rungs. If the silo is built in its most convenient location, that is close by the barn, the framing of the chute should be well fixed to both the wall of the barn and the silo; this will greatly strengthen the silo against strong winds.

(*See* insert for Bill of Material, Stave Silo No. 1.)

Stave Silo No. 2.

The construction of this differs from Silo No. 1 only in the form of foundation and in the doors.

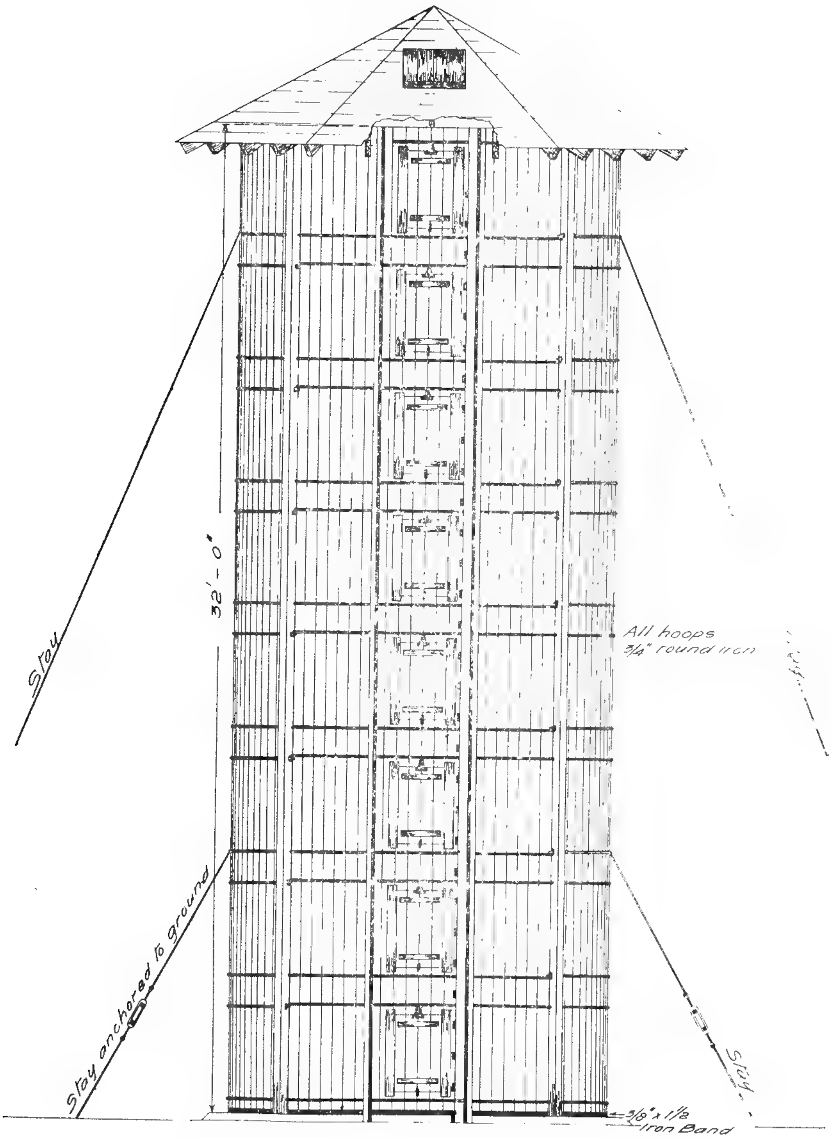
The foundation (Fig. 13) has already been discussed. One of the other forms (Figs. 1 and 3) may, of course, be used if preferred.

The doors (*see* Fig. 14) are the width of four staves, and are sawed out of the staves after the latter are erected. Before putting up the first of these staves, mark on it the position of all the doors, and start the saw-cuts enough to enable the blade of the saw to be inserted after the stave is in place (*see* Fig. 15); it may be necessary to nail a slat or the adjoining stave to this stave to prevent it from breaking when it is put up. The saw-cuts should be made on an angle of 45 degrees to the edge of the stave, so that the door opening will be smaller on the outside than on the inside. The doors will then be removable only toward the inside, and when the silo is filled the pressure of the silage will keep them tightly closed.

After the silo is erected and the hoops are tightened, mark off the top and bottom lines of each door, using the saw-cuts as a guide. Saw out the door pieces and fix them together with 2- x 2-inch battens. Bolt the two outside pieces to the battens, placing the nuts outside and sinking the bolt-heads flush with the inner surface; nails will do for the rest. Attach a hinge at the top of each door, bending the end of the hinge over the hoop above it. At the bottom of each door fix a button. Next put up the 1- x 4-inch door-stops and fix the doors in position. To open the doors, turn the button and spring the bent hinges off the iron hoop.

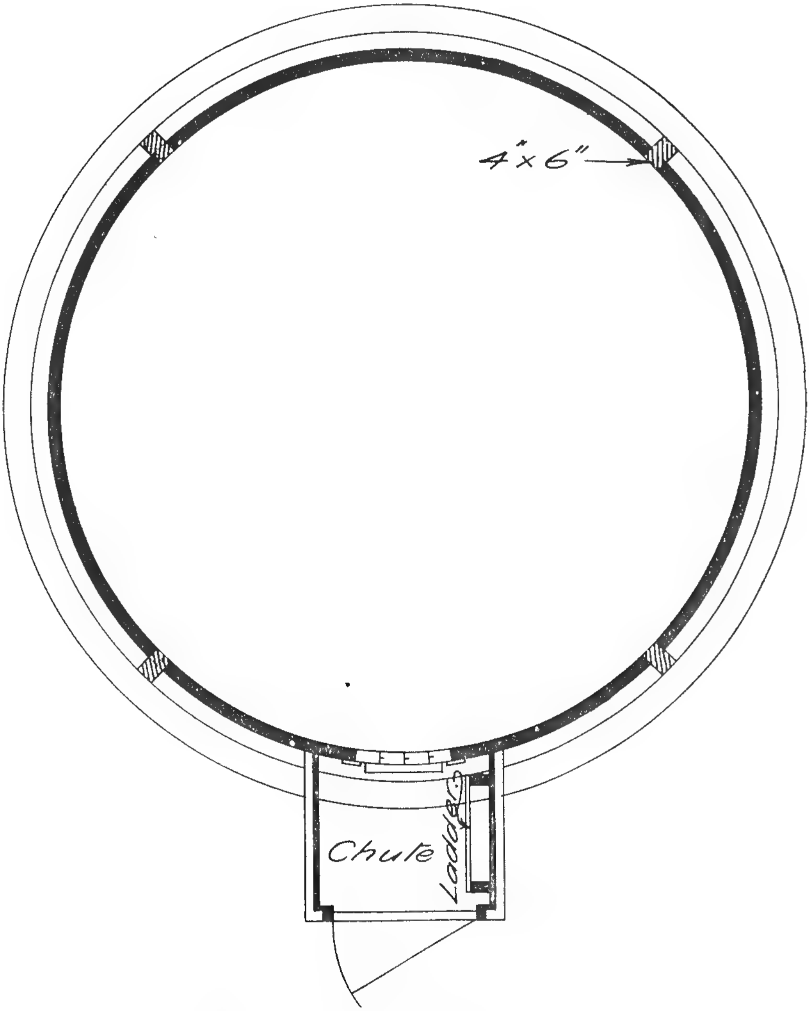
It is advisable to put the doors back in place after the silage is used down below them. They are then less apt to get lost or abused, and will help to keep the silo from drying out. Should any leakage

Stave Silo No. 2.



Elevation, front of chute removed.

Fig. 11. This differs from Silo No. 1 only in the doors and foundation. The doors are non-continuous, are the width of four staves, and are sawed out after the staves are erected.



Plan of Stave Silo No. 2.

Fig. 12. If the chute is connected with the barn it will be most convenient for feeding, and will greatly strengthen the silo against strong winds.

Stave Silo No. 2.

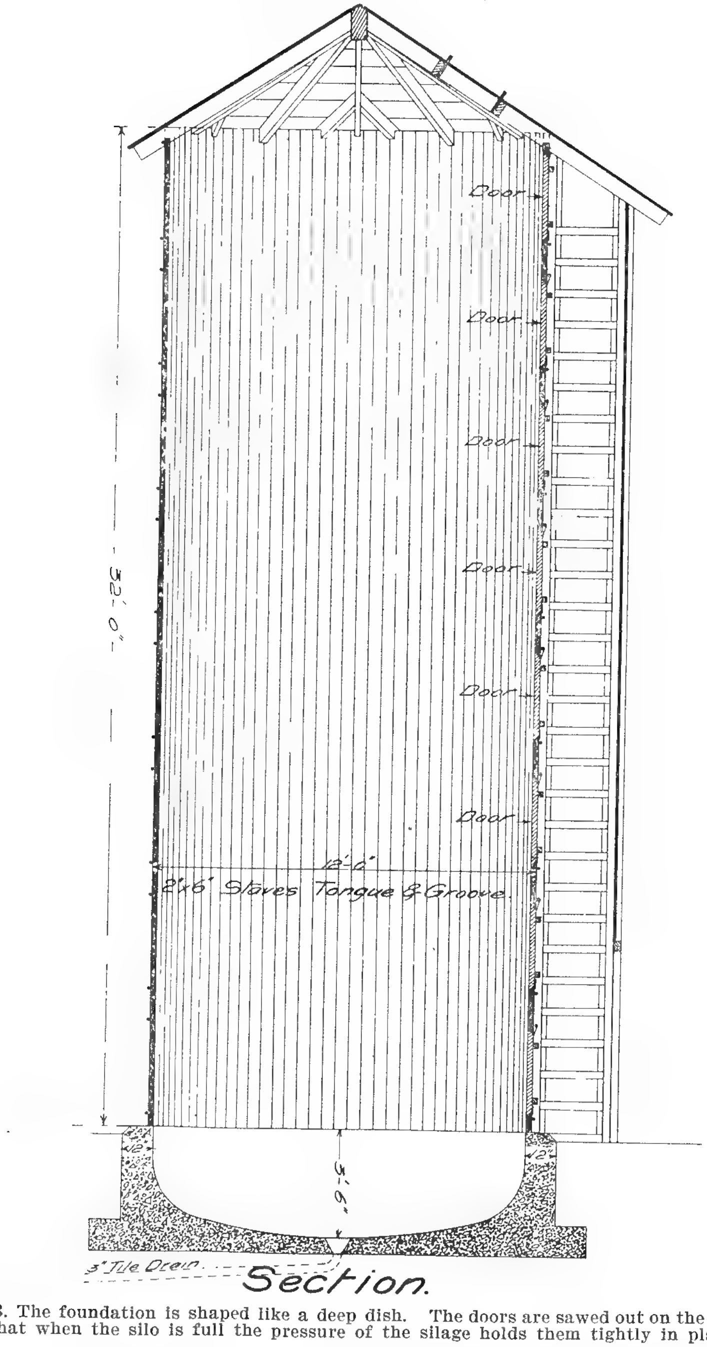


Fig. 13. The foundation is shaped like a deep dish. The doors are sawed out on the bevel, so that when the silo is full the pressure of the silage holds them tightly in place.

Details of door of Stave Silo No. 2.

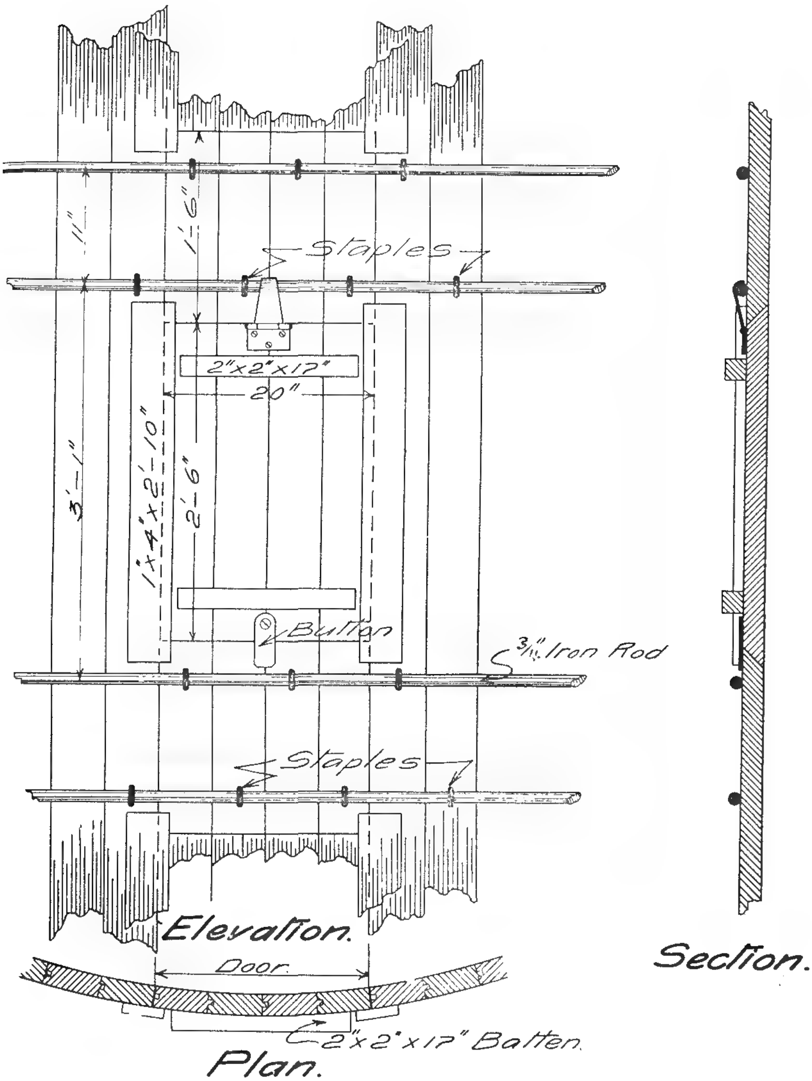


Fig. 14. When the silo is empty the doors are held in place by the hinge, the upper end of which is bent to hook over the hoop above it, and by the button.

of air occur around the doors, it can be kept out by putting strips of felt or heavy paper, or clay, in the joints before filling the silo.

If preferred, the continuous door shown on Silo No. 1 (Figs. 1 and 2) or the door shown in Fig. 10 may be used instead of the one described above.

(*See* insert for Bill of Material, Stave Silo No. 2.)

USING THE SILO.

The hoops will probably require periodical adjustment. After the silo is filled, if the tension appears to be too great, they should be slightly slackened. It may also prove necessary to tighten up the hoops in the dry weather of summer if the silo is then empty, slackening them again in fall when the silo is filled.

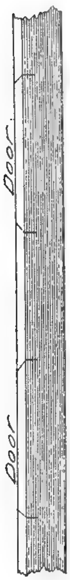


Fig. 15. A portion of a stave in which the saw-cuts for the doors have been started.

If the silo is carefully plumbed and guyed when first erected, the anchor-cables will need little attention afterward. It is advisable, however, to readjust them, and also the hoops if necessary, just before filling the silo—especially at the time of the first filling—to make sure the silo is round and plumb; otherwise it may settle out of shape and cause trouble. Should that ever happen, the silo could be straightened by taking a turn around the top with the guy-wires, and then pulling gradually on them with a traction-engine, or a team with block and tackle, or perhaps even a strong fence-stretcher; the best time to do this would be in summer, because the staves are then dry and easy to adjust.

The silo should be kept painted on the outside like any other building, to improve its appearance and increase its life. This should be done in summer, after the wood is thoroughly air-dried.

When filling the silo the silage should be packed down evenly and firmly in all parts, especially around the edges. If the crop is rather dry, as is apt to be the case with wheat or other grain crops, or with a crop that was frozen just before being cut, it is advisable to add water to make it pack down properly. After the silo is filled, the silage will settle considerably and more should then be put in, in order to pack the silo to capacity.

At the top of the silage, which is, of course, exposed to the air, a thin layer of partially decayed matter will form, which acts as a

protection to the silage underneath until the latter is to be fed. Other protection may be given, if desired, by sowing oats or placing a layer of chaff on top and then wetting it with water. It is also a good plan to put a foot or so of straw or chaff on the bottom of the silo before filling it, in order to prevent any loss of silage through air leaking around the bottom. Another method is to plaster clay around the bottoms of the staves; concrete should never be used for this purpose, because it would prevent adjustment of the staves. In feeding the silage it should be taken off evenly in layers, and not dug out in pockets.

As a stock-food silage is in many ways unsurpassed; there are, however, certain precautions which must be observed in using it. To get the best results it should not form the sole food, but hay (preferably leguminous) or other dry roughage should be fed with it; in the case of milking, fattening, or working animals, some kind of grain or meal should also be added. In feeding it is advisable to start with small quantities, gradually increasing the amount each day until the full ration is reached. It is best to feed silage to dairy cows either directly after milking, or else several hours before milking, so that the volatile odours of the silage will not taint the milk.

To what extent silage is injured by freezing is a debated question; but it is certainly more difficult to handle when frozen. In any case it should never be fed until after it has thawed out, and then it should be fed at once, before decomposition sets in. One way to thaw it out is to take the day's feed out of the unfrozen centre, and then to chop out the frozen silage around the sides and throw it in the middle, where it will probably thaw before next feeding-time. Another way is to mix the frozen and unfrozen silage together and allow it to stand in the feed-room overnight, or until the frost is entirely out of it.

Spoiled, mouldy, or very sour silage is dangerous to use. Spoiled (rotten) silage is, of course, unfit for food, while mouldy silage may cause poisoning or abortion (horses in particular are very susceptible to mould-poisoning); it is to prevent moulding or spoiling that it is so important that the silo should have tight, non-porous, non-conducting walls, and that the silage should be firmly packed down to expel and exclude all air. Very sour silage made from a too immature crop may cause colic. Special care should be taken that silage fed to horses is fresh and free from mould, and made from a fairly well-matured crop; the same applies to pregnant animals and to young animals.

ROOT CELLARS.

FIELD ROOTS.

Root-crops, like silage-crops, have not been grown to any considerable extent up to the present as a food for live stock on the prairies of Western Canada. This has been due, not to any drawback in soil or climate, but rather to the fact that the necessity for growing them has not been urgently felt in a country where the majority of farmers have been occupied almost exclusively in grain-growing, and the development of the live-stock industry is as yet comparatively small. However, the number of men who are raising live stock or who intend to branch out and make it an integral part of their farming operations is rapidly increasing, and to them at least the question is important and worthy of careful attention. The conditions of soil and climate are very favourable, and it is easily possible to produce very good yields —300 to 1,000 bushels per acre being common. Probably the two greatest drawbacks are the scarcity of labour, which often occurs during the growing and harvesting season, and the low winter temperatures, which make it difficult to keep roots satisfactorily during the winter months. The frost, however, can be kept out by properly built root-cellars, like the one herein described. The labour problem is not prohibitive, either, where only a comparatively small number of stock is kept, because in that case an acre or two in roots, if properly cared for, will be sufficient.

Field-roots, such as turnips, rutabagas, mangels, and carrots, stand unrivalled in some respects as a food for live stock. They can be fed to advantage to all classes of farm animals and furnish a succulent, juicy ration during the winter months when the bulk of the available feed is apt to be very dry and to a certain extent unpalatable. Roots are especially valuable as a feed for young and growing animals; not only are they greatly relished when fed alone, but when pulped and mixed with chaff or cut straw they add greatly to the palatability of the mixture.

Swede turnips or rutabagas will stand rather more frost than mangels and are perhaps somewhat easier to raise. They are excel-

lent keepers and can be kept well on into the spring for feeding ewes and early lambs. As a sheep-feed turnips are to be preferred to either mangels or carrots. When fed to milch cows care must be taken to accustom the cows to them gradually, or tainted milk will result. They are usually pulped when fed to cattle.

Mangels furnish excellent feed for milch cows and also are greatly relished by hogs. They will considerably cheapen the ration for the latter when fed pulped and mixed with meal.

Carrots require rather more labour to grow, but are a valuable root-crop. Horses in particular are very fond of them, and as a food for growing colts they have no equal. A few carrots fed each day to a colt will keep it in good health by cooling its blood, give a glossy, healthy appearance to its coat, and tend to improve its appearance generally.

All of the above can be grown successfully in Western Canada, and the stockman will find it greatly to his advantage to put in a limited acreage to roots, carefully thin and cultivate them during the growing season, and in the autumn safely store them for winter feeding to his stock.

STORING FIELD ROOTS.

A good root-cellar should be frost-proof, dry, well ventilated, convenient both for putting the roots in and removing them as required, without undue labour or danger of freezing them in extreme weather; and finally it should be easy and cheap to build.

To have a root-cellar frost-proof means, unless one can afford an expensive building insulated with many plies of lumber and paper, that it is necessary to put it deep enough in the ground to be below the frost-line. This depth amounts to 6 or 7 feet in the Prairie Provinces. A top cover of straw or manure, however, makes it unnecessary to go so deep, 3 or 4 feet of soil with a good depth of straw or manure on top being ample. Double doors are necessary in order to make the cellar accessible during cold weather without danger of freezing the roots. These doors should be built at least 6 feet apart. This will give a good vestibule, and it will be found that access can be gained without reducing the temperature very materially. It is a good idea to keep a thermometer in the root-cellar and control the temperature by opening or closing the ventilators. A dollar spent on a thermometer may be the means of saving a good many dollars' worth of roots.

Next to freezing there is nothing that will rot the vegetables quicker than having them alternately wet and dry. Therefore it is essential that a site be chosen that can be easily drained. The roof should be built up with sufficient crown to readily shed the water.

Good ventilation is essential and air inlets and outlets capable of adjustment and control should be provided. When the roots are first put in the cellar they should have all the ventilation possible. Later on as the weather gets colder the ventilators should be partially closed. If the thermometer is watched from day to day during the cold weather, the roots can easily be prevented from freezing. Where large quantities of roots are to be stored, ventilating ducts or boxes should be laid on the floor at intervals of 6 or 8 feet, with branches running from them to the top of the roots. These ducts should be about 15 inches square, built on a 2- x 2-inch frame, with 1- x 2-inch slats nailed on them 2 inches apart. Inlet ducts for fresh air should also be brought in along the floor of the passage-ways, with openings at intervals.

The most convenient place for a root-cellar is, of course, on the side of a hill. The driveway can then be built to the door on a level with the floor of the cellar, thus making it a great deal easier to carry the roots out than where steps have to be used, as in the case of a cellar built on level ground. Filling-chutes can be built in different parts of the roof, through which the bins may readily be filled with little labour. The chutes should be built of plank, with doors at the bottom as well as at the top. After the roots are in, the space between these two doors should be packed with straw.

The side-hill cellar lends itself to cheapness of construction. The upper 3 or 4 feet of earth should be stored on top of the bank to cover the roof of the cellar when built; the balance of the excavated earth may be taken down the hill to widen out a roadway in front of the door of the cellar. The roof should be well supported by beams and posts. These posts can be set on large stones, blocks of concrete, or cedar sills. If sills are used they can form the bottom of the dividing walls between the bins. If stones are used, care should be taken to see that they are firmly bedded, so that no settling will take place after the load comes on them. It is a good plan to grout under the post and on top of the stone with a little concrete to give the post a good bearing; often a good post is split by not having a good footing. Plank side walls may or may not be necessary, depending entirely upon the nature of the soil; if it is a good stiff clay there is no need to build

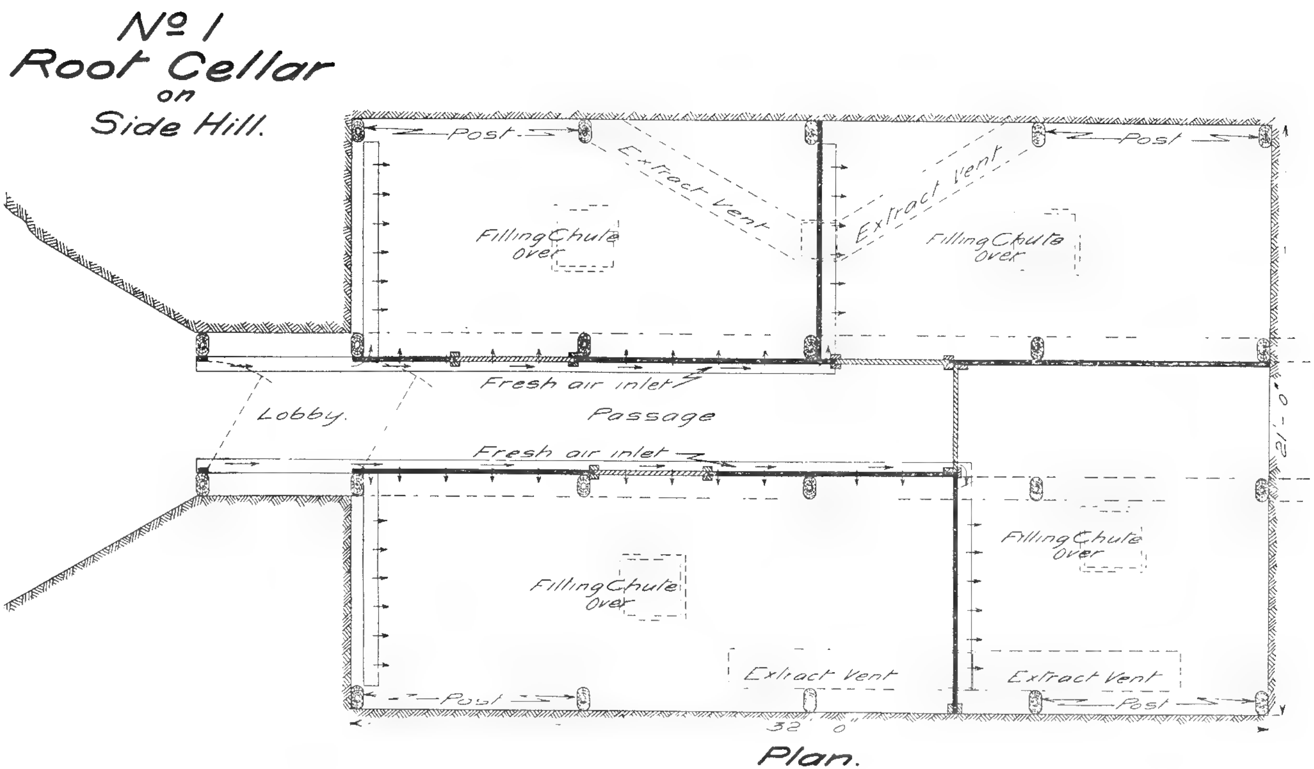


Fig. 16. A plan that meets all the requirements of a root-cellar. The size shown has a bin capacity of about 3,000 bushels, or 90 tons.

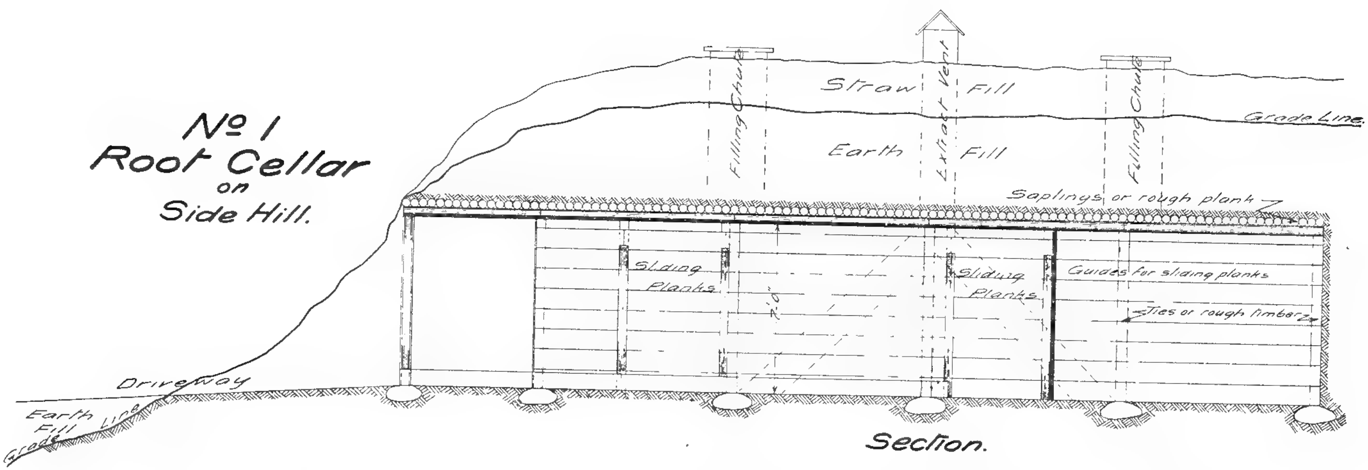


Fig. 17. It is designed for a side-hill; for level ground it would require merely the addition of steps at the entrance.

a side wall. The cross-beams should, however, be run well into the bank, so that there will be no danger of the earth breaking down under the load.

ROOT CELLAR No. 1.

The root-cellar illustrated in Figs. 16 and 17 meets the requirements as set forth above. It is designed for a side-hill; for level ground it would require merely the addition of steps at the entrance.

The drawings illustrate the form of construction and method of ventilation. Filling-chutes are shown over the centre of each bin. For posts and beams sound old railroad-ties, fence-posts, or rough timbers can be used. The roof of the root-cellar may be built of rough planks or strong poles laid on the beams. To give the longest service all the wood should be peeled (if necessary) and thoroughly air-dried first, and then well soaked or coated all over with hot creosote, tar, or some other good preservative. This treatment should be given in warm weather to secure the greatest penetration of the preservative.

The size will, of course, be regulated by the quantity of roots to be stored. The following bill shows the materials needed for a root-cellar of the size shown on the plan, which has a bin capacity of about 3,000 bushels, or 90 tons; for a larger or smaller cellar the bill must be modified to suit.

BILL OF MATERIAL, ROOT CELLAR No. 1.

22 posts, 6" x 6" or larger, 7' long.
4 beams, 6" x 8" or larger, 16' long (or 8 beams 8' long).
6 beams, 6" x 8" or larger, 10' long (these run into the earth side-walls about 18").
2 beams, 6" x 8" or larger, 14' long.

NOTE.—The above may be sound old railroad-ties or sound rough timbers.

70 to 100 poles, 4" to 6" in diameter, 22' long, for roof.

33 pieces 3" x 12" x 14'. 33 pieces 3" x 12" x 8'. 6 pieces 3" x 12" x 6'.	Rough plank to be used for roof if poles are not available.
7 pieces 2" x 12" x 12'. 21 pieces 2" x 12" x 9'. 7 pieces 2" x 12" x 8'. 35 pieces 2" x 12" x 4'. 19 pieces 2" x 4" x 7'. 16 pieces 2" x 2" x 12'.	Wall planking next passage, including short movable boards in doorway of each bin.

800 lineal feet 1" x 2" strips for lattice sides of extract vents and fresh-air inlets.
200 lineal feet 1" x 6" rough boards for fresh-air inlet shafts.
24 pieces 2" x 2" x 8' for corner framing of filling-chutes and extract ventilator-shafts.

480 feet, board measure, 1″ sawn board or shiplap for sides, roofs, and doors of filling-chutes and extract ventilator-shafts, and for entrance doors to root-cellar.
2 pairs 12″ T-hinges.
2 thumb-latches.

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FOREST SERVICE.

HON. WILLIAM R. ROSS, K.C., Minister of Lands.

Wood as a Building Material.

Wood is supreme for **all-round usefulness.**

It is the **cheapest** building material obtainable.

It is also the **lightest.**

It is the **strongest,** weight for weight.

It is the **easiest** to work; **any one** can use it.

A wooden building is by far the **simplest** to **erect.**

Wood is **attractive in appearance** and has **great variety** and **beauty** for interior finish.

Unlike metal and masonry, wood is almost a **non-conductor** of **heat** and **cold.**

A building with wooden walls and a wooden shingle roof is **warm** in winter and **cool** in summer and **dry** all the time.

Wood is therefore particularly **suitable** for **houses** and **barns.**

Wood is very **durable** in all kinds of building work **above ground.**

It will give **generations** of service, especially if well painted where exposed to the weather.

For use in **contact** with the **soil,** as mud-sills or fence-posts, a preservative should be applied or a specially resistant wood such as Western Red Cedar should be used.

Woods to Use.

Grown in British Columbia---Manufactured in British Columbia.

Woods differ in their qualities of strength, hardness, and durability. Certain kinds are particularly suited for certain uses. It is important to use the right wood in the right place.

(1.) **General Building Work.**—Douglas Fir, Western Larch, Western Hemlock, Mountain Western Pine, Mountain and Coast Spruce, Western White Pine.

(2.) **Framing and Dimension Timber, Posts, Beams, Rafters, Studs, Sills, Plates, Joists.**—Light construction: Same as No. 1. Heavy construction: Douglas Fir, Western Larch, Western Hemlock.

(3.) **Rough Lumber or Sheathing not exposed to Weather (Inside Work or covered by Siding or Lath and Plaster).**—Any British Columbia wood.

(4.) **Rough Outside Sheathing exposed to Weather (Outbuildings, etc.).**—Douglas Fir, Western Larch, Mountain Western Pine, Western Red Cedar, Coast and Mountain Spruce, Western White Pine.

(5.) **Siding.**—Western Red Cedar, Douglas Fir, Mountain Western Pine, Mountain and Coast Spruce.

(6.) **Roofing.**—Western Red Cedar edge-grain shingles, with galvanized, zinc-clad, zinc, or copper nails.

(7.) **Flooring, Stair Stepping, Sidewalks.**—Douglas Fir, Western Larch, Western Hemlock. Use edge-grain stock for hardest wear.

(8.) **Interior Finish, Panelling, Trim.**—Douglas Fir, solid or veneer (a beautiful grain, superior to most hardwoods), Western Larch, Western Hemlock, Western Red Cedar, Mountain Western Pine, Western White Pine.

(9.) **Doors, Window-sash.**—Douglas Fir, Western Red Cedar, Western Larch, Mountain Western Pine, Western White Pine.

(10.) **Fence-pickets.**—Douglas Fir, Western Larch, Western Red Cedar, Mountain Western Pine.

(11.) **Piling, Cribbing.**—Douglas Fir, Western Larch.

(12.) **Silos, Tanks.**—Douglas Fir, Western Larch, Western Red Cedar.

(13.) **Ground-sills, Skids, Fence-posts, Poles, Conduits, Drains, and wherever Wood is in Contact with the Ground.**—Western Red Cedar or creosoted wood. Use Douglas Fir or Western Larch where strength and hardness are essential.

(14.) **Furniture, Tables, Settees, etc.**—Douglas Fir, Mountain Western Pine, Coast or Mountain Spruce, Western White Pine, Western Red Cedar.

NOTE.—Western Hemlock is superior in every way to Eastern Hemlock—an entirely different tree—and should not be confused with it.

In ordering lumber it is well to remember that short lengths (i.e., under 10 feet) cost less than long lengths, and where they will answer the purpose it pays to specify them. For example, it is cheaper to buy 6- and 8-foot lengths than to cut them out of 12- and 16-foot lengths.

BRITISH COLUMBIA FOREST SERVICE BULLETINS.

Farm Buildings Series.

1. Combination or General Purpose Barns for Prairie Farms.
2. Dairy Barns, Milk and Ice Houses for Prairie Farms.
3. Beef Cattle Barns for Prairie Farms.
4. Horse Barns for Prairie Farms.
5. Sheep Barns for Prairie Farms.
6. Piggeries and Smoke Houses for Prairie Farms.
7. Poultry Houses for Prairie Farms.
8. Implement Sheds and Granaries for Prairie Farms.
9. Silos and Root Cellars for Prairie Farms.
10. Farm Houses for Prairie Farms.

Timber Series.

11. British Columbia Box Woods.
12. How to finish British Columbia Woods.
13. British Columbia Tie Timber.
14. British Columbia Dimension Timber.

The above bulletins, and also further information concerning British Columbia lumber, are obtainable **free** from the Chief Forester, Victoria, B.C. Of the Timber Series, Bulletin No. 12, "How to finish British Columbia Woods," is of special interest to home builders and owners, carpenters, architects, and building contractors.

OTHER PUBLICATIONS.

Many publications and much useful information on farming and related subjects can be obtained on request from the various Government Public Service organizations of Canada, listed below.

(1.) **Alberta:**
Department of Agriculture, Edmonton.
University of Alberta, Edmonton.
Agricultural Schools at Olds, Vermilion, and Lethbridge.
Dominion Experimental Stations at Lethbridge, Lacombe, and Fort Vermilion.

(2.) **British Columbia:**
Department of Agriculture, Victoria, B.C.
Dominion Experimental Farm, Agassiz, and Experimental Stations at Sidney, Salmon Arm, Summerland, and Invermere.

(3.) **Dominion:**
Department of Agriculture, Ottawa, Ont.
Dominion Forestry Branch, Ottawa, Ont.

(4.) **Manitoba:**
Department of Agriculture, Winnipeg.
Manitoba Agricultural College, Winnipeg.
Dominion Experimental Farm, Brandon, and Experimental Stations at Morden.

(5.) **Saskatchewan.**
Department of Agriculture, Regina.
University of Saskatchewan, Saskatoon.
Dominion Experimental Farm, Indian Head; Forestry Station, Indian Head; and Experimental Stations at Scott and Rosthern.

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Pulp and Paper, Bridge Timbers, Mine
Props, Elevator Cribbing, Tele-
phone Poles, Piling, Railway
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Paving Blocks,
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and numerous other products.